

CLAIMS

- 1) A lumping method for estimating the properties or the behaviour of liquid and/or vapour hydrocarbon phases from data relative to a reference set consisting of hydrocarbon mixtures in a series of thermodynamic states resulting from determined conditions of production of an underground hydrocarbon reservoirs, characterized in that it comprises :
- grouping each one of said hydrocarbon mixtures into at least three constituents (V, I, H), none of these constituents corresponding to a particular selection of base components or pseudo-components that would be used for a detailed compositional description of the fluids, considering that the gas phases resulting from the separation under surface conditions of each one of the hydrocarbon mixtures are mixtures from which third constituent (H) is excluded, and that the oil phases resulting from the separation under surface conditions of each one of the hydrocarbon mixtures are mixtures from which first constituent (V) is excluded,
 - determining by material balance the compositions of the separation products comprising, for the gaseous products, at least the first and the second constituent (V, I) in variable proportions and, for the liquid products, at least the second and the third constituent (I, H) in variable proportions, and
 - determining the at least three-constituent composition of each hydrocarbon mixture of the reference set by combination of the products of the separation thereof in proportion to the amounts of each separation product.

2) A method as claimed in claim 1, wherein each one of the hydrocarbon mixtures is grouped into only three constituents (V, I, H), the gas phases resulting from said separation being mixtures in variable proportions of first constituent (V) and of second constituent (I), the oil phases resulting from said separation are mixtures in variable proportions of second constituent (I) and of third constituent (H), and the three-constituent composition is determined.

3) A method as claimed in claim 1 or 2, wherein the surface conditions are the conditions encountered or expected during reservoir production.

4) A method as claimed in claim 1 or 2, wherein the surface conditions are different from the conditions encountered or expected during reservoir production.

5) A method as claimed in claim 1 or 2, wherein the material balance is a mass balance and a molar mass is assigned to each one of the three constituents (V, I, H) after quantitative analysis of the molar masses of the separation products of the reference set.

6) A method as claimed in claim 1 or 2, wherein the data necessary for equilibrium calculation and for modelling the phase properties in the lumped representation are defined using the compositions of the phases in the lumped representation and known or estimated a priori data relative to at least the density and the viscosity of the oil and gas phases at equilibrium belonging to the reference set.

7) A method as claimed in claim 6 wherein, when said data includes detailed compositional data of the phases previously represented by a state equation, the parameters of a first state equation of the lumped representation, used for modelling the phase properties, are defined using this compositional data.

8) A method as claimed in claim 6, wherein the parameters of a second state equation of the lumped representation, useful for equilibrium calculations, are adjusted in order to reproduce the equilibrium coefficients of the lumped representation.

9) A method as claimed in claim 8, wherein the parameters per constituent of the lumped representation in the first state equation are used in the adjustment procedure for defining the parameters of the second state equation of the lumped representation useful for equilibrium calculations.

10) A method as claimed in any one of the previous claims, wherein the equilibrium coefficients of the fluids are determined in a detailed compositional representation, from variables and/or parameters involved in the calculation of the phase properties, from the moment that the parameters useful for calculation of the phase properties in the lumped representation have been estimated so as to reproduce the parameters of the phases in the state equation of the detailed compositional description.

11) A method as claimed in any one of the previous claims, comprising delumping for predicting as a function of time, and in at least one thermodynamic zone, a detailed composition of a fluid contained in a hydrocarbon reservoir or produced by at least one well.

12) A method as claimed in claim 11, comprising :

- representing the reservoir in form of a network of grid cells (m) wherein each one forms an elementary volume filled with fluids in form of one or more phases, with at least one non-aqueous phase,
- defining, for each thermodynamic zone or range, the fluids by a detailed base representation, so as to determine the amount of each base constituent (i) in each

hydrocarbon phase in each grid cell (m) at the time defined as initial for the delumping calculation,

- per thermodynamic zone for which a lumped representation of the fluids is selected, determining a state equation constructed prior to dynamic reservoir simulation with the lumped representation, to reproduce the phase parameters, in the state equation of the detailed representation, of the hydrocarbon fluids along thermodynamic paths considered to be representative of those that will be followed by the hydrocarbon fluids during the gridded simulation,
- carrying out, at a time interval t , a compositional simulation with a limited number of constituents wherein the phase properties are calculated by a state equation, said simulation allowing to calculate at least in each grid cell (m) and at consecutive time intervals a pressure for a hydrocarbon phase, the temperature when it varies, the flow rates of the phases between grid cells and at the production and injection perforations, and the values of parameters and/or phase properties involved in the formal expression of the equilibrium coefficients of the detailed representation, and storing these various quantities,
- estimating at the next time interval $(t+1)$ the molar fraction of each constituent i in the global detailed composition of the hydrocarbon fluid in grid cell (m) by material balance on grid cell (m),
- determining, using the quantities stored, at the same time interval $(t+1)$ and in each grid cell (m), the equilibrium coefficients of each constituent (i) in the detailed representation,
- determining, in the same time interval $(t+1)$, the vaporized fraction in each grid cell (m), and

- estimating the detailed composition of each hydrocarbon phase, at the same time interval $(t+1)$ and in each grid cell (m) .

13) A method as claimed in any one of the previous claims, wherein various stages are translated so as to produce intermediate or final results usable in equations
5 expressed according to a molar or mass formalism.